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# GAUTIERIA IN NORTH AMERICA<sup>1</sup>

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## GAUTIERIA

*Gautieria* Vittadini, Monogr. Tuberac. 25–27. 1831; Klotzsch in Dietr. Fl. Boruss. (Fl. Königr. Preuss.) 7 : No. 764. pl. 464. 1839; Tulasne, Fung. Hypog. 62–63. 1851; Zobel in Corda, Icon. Fung. 6 : 33–34. 1854; Winter in Rabenh. Krypt.-Fl. Deutschl. ed. 2, 1 : 873–874. 1884; DeToni in Sacc. Syll. Fung. 7 : 177–179. 1888; Hesse, Hypog. Deutschl. 1 : 105–110. 1891.—*Gautiera* Endlicher, Gen. Pl. 30. 1836–1840; Corda, Anleit. z. Stud. Myc. 114. 1842; Icon. Fung. 5 : 28. 1842; Rabenhorst, Deutschl. Krypt.-Fl. 1 : 252. 1844; Fries, Summa Veg. Scand. 435. 1849.—Not *Gautiera* Rafinesque, Med. Fl. 1 : 202. 1828.

The type species of the genus is *Gautieria morchelliformis* Vittadini.

Fructifications globose to somewhat irregular, with a simple or branched rhizomorph; columella variable in size and shape; peridium thin, fugacious; gleba white at first, becoming colored by the masses of spores; cavities variable in size, often elongated, labyrinthiform; septa homogeneous, composed of closely interwoven, parallel hyphae, not conspicuously gelatinized at maturity; basidia clavate, usually 2-spored, with long filiform sterigmata; spores ellipsoidal to citriform, unicellular, with longitudinal thickenings of the cell wall.

Although *Gautieria* was originally described as lacking a peridium, it has been reported<sup>2</sup> to have one in its early stages of development. For this reason we are inclined to consider *Chamonixia* Rolland as synonymous with *Gautieria*, but since

<sup>1</sup> Issued May 24, 1918.

<sup>2</sup> Corda, A. C. J. Icones Fungorum 6 : 33. 1854; Hesse, R. Die Hypogaeen Deutschlands 1 : see p. 106. 1891; Fitzpatrick, H. M. A comparative study of the development of the fruit-body in *Phallo-gaster*, *Hysterangium*, and *Gautieria*. Ann. Myc. 11 : 119–149. pl. 4–7. f. 1–4. 1913.

we have not studied the type material, we prefer not to change the name.

Although we have had the opportunity to study a few specimens which were put up in alcohol, our descriptions are based on dry herbarium specimens, as is also our key. As a standard for color descriptions we have used Ridgway, 'Color Standards and Nomenclature,' Washington, D. C., 1912. As to the citation of specimens, the data given is that received with the specimens. The location of all specimens is designated by giving in parenthesis the name of the herbarium preceded by "in."

We are indebted to the Missouri Botanical Garden for the use of the library and herbarium; to Dr. E. A. Burt for helpful suggestions; to Dr. LeRoy Abrams for the privilege of studying Harkness's type; to Mr. S. H. Burnham for his collections; to Dr. H. M. Fitzpatrick for specimens from New York; to Dr. N. L. Gardner for his collections; to Mr. C. G. Lloyd for the privileges of his herbarium; to Dr. W. A. Murrill for collections from the New York Botanical Garden Herbarium; to Mrs. F. W. Patterson for specimens from the Pathological Collections, Bureau of Plant Industry, United States Department of Agriculture; and to Dr. J. R. Weir for specimens from Idaho.

#### KEY TO THE NORTH AMERICAN SPECIES

1. Spores mostly more than 14  $\mu$  long..... 2
1. Spores mostly shorter than 14  $\mu$ ..... 4
  2. Superficial cavities large and prominent.....*G. morchelliformis* (p. 134)
  2. Superficial cavities small..... 3
3. Septa wholly composed of slender hyphae.....*G. graveolens* (p. 136)
3. Septa composed of a pseudo-parenchyma; the subhymenium of large, angular cells .....*G. Trabuti* (p. 137)
  4. Slate-colored to nearly black; columella long; cystidia present....  
.....*G. plumbea* (p. 138)
  4. Brownish; columella short; cystidia absent.....*G. monticola* (p. 139)

1. **Gautieria morchelliformis**<sup>1</sup> Vittadini, Monogr. Tuberae. 26. 1831; Klotzsch in Dietr. Fl. Boruss. (Fl. Königr. Preuss.) 7: No. 764. 1839, in part; Tulasne, Fung. Hypog. 62. 1851; Corda, Icon. Fung. 6: 34. 1854; Winter in Rabenh. Krypt.-Fl.

<sup>1</sup> Originally spelled *morchellaeformis*.

Deutschl. ed. 2, 1: 873. 1884; DeToni in Sacc. Syll. Fung. 7: 177–178. 1888; Hesse, Hypog. Deutschl. 1: 109–110. 1891.

*Gautieria morillaeformis* Quelet, Ench. Fung. 250. 1886.—*Gautieria villosa* Quelet, Soc. Bot. Fr. Bull. 25: 290. 1878 (often cited as Champ. du Jura et des Vosges, Suppl. 6: 290. 1878); Ench. Fung. 250. 1886; Winter in Rabenh. Krypt.-Fl. Deutschl. ed. 2, 1: 873. 1884; DeToni in Sacc. Syll. Fung. 7: 178. 1888.

Illustrations: Bucholtz, Ann. Myc. 1: pl. 5. f. 14; Corda, Icon. Fung. 6: pl. 7. f. 62; Bail in Nees v. Esenbeck, Th. F. L. & Henry, A. Syst. d. Pilze 2: pl. 27. f. 1–4; Vittadini, Monogr. Tuberac. pl. 3. f. 6; Klotzsch in Dietr. Fl. Boruss. (Fl. Königr. Preuss.) 7: pl. 764.

Type: location unknown to us.

Fructifications globose to oblong, 1–3 cm. in diameter, with a basal stalk-like rhizomorph, usually much branched; columella rudimentary, merely a subglobose summit of the rhizomorph; peridium thin in early stages, quickly evanescent; gleba ochraceous-tawny to hazel; cavities 1–6 mm. in diameter, subglobose to irregular; septa white when broken, hyaline to cream-colored under the microscope, composed of a stupose mat of hyphae, about 75  $\mu$  broad; basidia about as large as the spores, hyaline, granular, 2–3-spored; sterigmata filiform, as long as the spores; cystidia in the upper cavities of the fructification, not prominent; paraphyses clavate, septate, hyaline; spores fusiform to citri-form, ochraceous, longitudinally striate, with 8–10 usually smooth striations, 1–2-guttulate, pedicellate, 12–24 $\times$ 8–12.5  $\mu$ .

In clay soil. Europe and United States. Spring and summer.

We have placed *Gautieria villosa* Quelet in synonymy, for we have been unable to distinguish it from *G. morchelliformis*, and Quelet himself later (1886) believed them to be the same species. Winter studied the type, as well as Bresadola's collection, which we have studied, and he believes they are synonymous. The villous character to which Quelet had reference might have been the granular appearance often produced by an accumulation of spores on the surface of the gleba.

## Specimens examined:

Exsiccati: Roumeguère, Fung. Gall. Exsicc., 2218, under the name *G. villosa*.

Austria: Bohemia, Tabor, *F. Bubak* (in Lloyd Mus., 05860); Tyrol, near Magras, *G. Bresadola*, in Roumeguère, Fung. Gall. Exsicc., 2218 (in N. Y. Bot. Gard. Herb.).

France: Jura, *N. Patouillard* (in Lloyd Mus., 08+53).

New York: Washington Co., Hudson Falls, *S. H. Burnham* (in Burnham Herb., Dodge Herb., 850, and Zeller Herb., 1449).

California: Claremont, *L. M. Clency* (in Pomona Coll. Herb., 1759, and in Lloyd Mus., 1759); San Jose, *H. E. Parks* (Univ. Cal. Herb., 541, Zeller Herb., 1457, and Dodge Herb., 860).

**2. *Gautieria graveolens* Vittadini, Monogr. Tuberac. 27. 1831; Tulasne, Fung. Hypog. 63. 1851; Corda, Icon. Fung. 6: 34. 1854; Winter in Rabenh. Krypt.-Fl. Deutschl. ed. 2. 1: 873-874. 1884; DeToni in Sacc. Syll. Fung. 7: 178. 1888; Quelet, Ench. Fung. 250. 1886; Hesse, Hypog. Deutschl. 1: 106-108. 1891.**

*Gautieria graveolens?* Chatin, La Truffe, 82-83. 1892.—*Gautieria graveolens* var. *mexicana* Fischer in Engler & Prantl, Die Nat. Pflanzenfam. I. 1<sup>\*\*</sup>: 305. 1899.

Illustrations: Bucholtz, Ann. Myc. 1: pl. 5. f. 14; Chatin, La Truffe, pl. 15. f. 4; Corda, Icon. Fung. 6: pl. 7. f. 63; Fischer in Engler & Prantl, Die Nat. Pflanzenfam. I. 1<sup>\*\*</sup>: 304; Fitzpatrick, Ann. Myc. 11: pl. 4. f. 11, pl. 7. f. 30-37; Hesse, Hypog. Deutschl. 1: pl. 2. f. 5-9, pl. 7. f. 4-6; Vittadini, Monogr. Tuberac. pl. 4. f. 3.

Type: in Saccardo Herb. at Padua.

Fructifications globose, 1-2 cm. in diameter, light ochraceous-buff to Prout's brown; stipe slender and fragile, up to 1 cm. long, 1 mm. thick; columella frequently reaching the center of the fructification, forking; odor very strong, suggestive of decaying onions; peridium thin, composed of delicate, thin-walled, loosely woven hyphae, soon rupturing and disappearing; gleba ochraceous-tawny to cinnamon-brown; cavities globose or elongated, minute, empty; septa 40-80  $\mu$

thick, composed of small hyphae, compact; cystidia clavate to subfusiform, hyaline, often obscured by the spores; paraphyses linear, septate; basidia broadly clavate, 2-spored,  $12-16 \times 8-9 \mu$ , with long filiform sterigmata; spores ochraceous-tawny, usually with 10 prominent striations, the latter smooth or nearly so, apex rounded, base pedicellate,  $18-19 \times 11-12 \mu$ , often with a large oil globule.

Deeply buried under leaf mould. Europe and North America. Summer.

Specimens examined:

Exsiccati: Saccardo, D. Mycoth. Ital., 427; de Thümen, Mycoth. Univ., 12.

Austria: Bohemia, Vysoky, Chluniec ad Selcany, *F. Bubak* (in Lloyd Mus., 058590); Tyrol, Cavelonte, *G. Bresadola*, in D. Saccardo, Mycoth. Ital., 427 (in U. S. Dept. Agr., Bur. Pl. Ind. Path. Coll.).

Germany: Saxony, Eisleben, *J. Kunze* (collections in Lloyd Mus., 05916, and in Mo. Bot. Gard. Herb., 5637); *G. Winter*, in de Thümen, Mycoth. Univ., 12 (in Lloyd Mus., Mo. Bot. Gard. Herb., and U. S. Dept. Agr., Bur. Pl. Ind. Path. Coll.).

New York: Ithaca, *H. M. Fitzpatrick* (in N. Y. Coll. Agr. at Cornell Univ., Dept. Pl. Path. Herb., 8450).

**3. *Gautieria Trabuti*** (Chatin) Patouillard, Soc. Myc. Fr. Bull. **13**: 203-204. 1897.

*Hymenogaster Trabuti* Chatin, Soc. Bot. Fr. Bull. **38**: 64. 1891.

Illustrations: Patouillard, Soc. Myc. Fr. Bull. **13**: pl. 13. f. 2.

Type: probably in Patouillard Herb. but unknown to us.

Fructifications subglobose, about 3 cm. in diameter, surface convoluted, Verona brown in preserved material; stipe slightly developed, arising from very fine, brown rhizomorphs of septate hyphae with prominent clamp connections; columella dendroid; peridium made up of loosely woven, large, septate hyphae with swollen cells, soon evanescent; gleba Brussels-brown; cavities irregular, empty; septa hyaline,  $180-240 \mu$  thick, composed of a pseudo-parenchyma of

large, subglobose to polygonal cells; cystidia subcylindric, thin-walled,  $8\ \mu$  in diameter; paraphyses filiform, septate, guttulate,  $3\text{--}4\ \mu$  in diameter; basidia hyaline, many-guttulate,  $25\text{--}30 \times 10\text{--}16\ \mu$ , obovate to clavate, mostly 4-spored; sterigmata stout,  $5\text{--}8\ \mu$  long; spores acrogenous, 1-3-guttulate, cinnamon to cinnamon-buff, short-pedicellate, globose when young, becoming ellipsoidal,  $16\text{--}21 \times 8\text{--}10\ \mu$ , with 5-9 striations usually prominently warted.

Deeply buried in forests. Algeria and California. April. Specimens examined:

California: San Jose, *H. E. Parks* (in Univ. Cal. Herb., 493, Zeller Herb., 1455, and Dodge Herb., 858).

#### 4. *Gautieria plumbea* Zeller & Dodge, sp. nov.

Fructificationes ovatae, 4 cm. diametro metiens, cordis effigies, superficie convoluta, "light brownish olive" vel "mummy-brown" (Ridgway); stipes 2 mm. crassitudine; columella ramosa, fere fructificationem percurrens, translucens; gleba "plumbeous-black" vel "slaty" (Ridgway) servata, "fuscous-black" (Ridgway) siccata, gelatinosa; locelli irregulares, vacui; septa hyalina, circa  $300\ \mu$  crassitudine, hyphis gelatinosis confecta; stratum subhymeniale pseudo-parenchymate, id est, cellulis polygoniis confectum; cystidia magna,  $52\text{--}61 \times 25\text{--}35\ \mu$ , hyalina, granulate guttulata, obovata, saepe subapiculata; paraphyses anguste clavatae, granulate guttulate, septatae,  $4\text{--}5\ \mu$  crassitudine, partim apice bullatae, partim filiformes; basidia hyalina, granulate guttulata, clavata,  $20\text{--}26 \times 9\text{--}10\ \mu$ , mono- vel tetraspora, sterigmatibus brevibus; sporae  $11\text{--}16 \times 6.5\text{--}8\ \mu$ , breviter pedicellatae, longitudinaliter striatae, striis  $7\text{--}10$ , sinuosis, "English red" vel "burnt sienna" (Ridgway); sporae iuniores ovatae vel ellipsoideae, breviter pedicellatae, leves, deinde striatae.

Habitat in terra in pinetis. Idaho. Autumno.

Type: in Weir Herb., Zeller Herb., and Dodge Herb.

Fructifications ovate, 4 cm. in diameter, heart-shaped, surface convoluted, light brownish olive to mummy-brown; stipe 2 mm. thick; columella branched, trunk reaching almost to the top of the fructification, translucent; gleba plumbeous-black, slaty when in preservative, drying fuscous-black, gelatinous; cavities irregular, empty; septa hyaline, about  $300\ \mu$  thick, composed of gelatinized hyphae; subhymenial layer a pseudo-parenchyma of large angular cells; cystidia large,  $52\text{--}61 \times 25\text{--}35\ \mu$ , hyaline, granularly guttulate, obovate, often somewhat apiculate; paraphyses narrowly clavate, hyaline,

granularly guttulate, septate, 4–5  $\mu$  broad, some knobbed at the tip, some filiform; basidia hyaline, granularly guttulate, clavate, 20–26 $\times$ 9–10  $\mu$ , 1–4-spored; sterigmata less than half the length of the spores; spores 11–16 $\times$ 6.5–8  $\mu$ , short-pedicellate, longitudinally striate, with 7–10 wavy striations, from English red to burnt sienna; young spores ovate to ellipsoidal, short-pedicellate, smooth, then striate.

Under conifers. Idaho. September to October.

The color of the gleba and the prominence of the columella make this species distinct from all others. It is most closely allied with *G. Trabuti* in tramal characters, but the spores are more nearly the size of *G. monticola* than those of any other species.

Specimens examined:

Idaho: Priest River, *J. R. Weir*, type (in Weir Herb., in Zeller Herb., 1458, and Dodge Herb., 859).

**5. *Gautieria monticola*** Harkness, Cal. Acad. Sci. Bull. **1**: 30. 1884; DeToni in Sacc. Syll. Fung. **7**: 178–179. 1888.

*Hymenogaster monticolus* Harkness, Cal. Acad. Sci. Proc. Bot. III. **1**: 249. 1899.

Type: in Dudley Herb. at Leland Stanford Jr. Univ. and in N. Y. Bot. Gard. Herb.

Fructifications irregularly lobed, nearly plane above and below, 10 cm. in diameter (Harkness), about 3 cm. thick, Dresden brown to mummy-brown; stipe short, slender, darker; columella short, branching, concolorous with the stipe; peridium evanescent; gleba ochraceous-tawny, grayish where cut, due to the thick, hyaline septa; cavities irregular, more or less anastomosing, nearly filled with spores when dry; septa 140–400  $\mu$  thick, hyaline, composed of more or less gelatinized hyphae, mostly parallel with the hymenial surface; cystidia none; basidia arising from erect, septate hyphae, hyaline, 16 $\times$ 6–7  $\mu$ , ovate, mostly 2-spored; sterigmata filiform, 7–10  $\mu$  long; spores acrogenous, 1–several-guttulate, ochraceous-tawny, short-pedicellate, ellipsoidal to obovate, 9–13 $\times$ 6.5–8  $\mu$ , with 7–10 longitudinal or oblique striations sometimes slightly warted.

On the ground under conifers. California. July.



## Specimens examined:

California: Mariposa County, Big Meadow, *W. A. Setchell* (in Univ. Cal. Herb., 542, Zeller Herb., 1454, and Dodge Herb., 857); Big Tree Grove, *H. W. Harkness*, 113 [3543], type (in Dudley Herb. at Leland Stanford Jr. Univ. and N. Y. Bot. Gard. Herb.).

## EXTRA-LIMITAL AND DOUBTFUL SPECIES

The following are descriptions of species not yet found in North America, but are included in order to assist in referring material to them in case they should be discovered later, as individual species are found to have a wide range. The descriptions are either copies or translations of the original descriptions, since no material here has been studied. Such notes are appended to them as seemed justified by a careful study of the original text and illustrations.

1. *Chamonixia caespitosa* Rolland, Soc. Myc. Fr. Bull. 15 : 76. 1899; Saccardo and Sydow in Sacc. Syll. Fung. 16 : 251. 1902.

Illustrations: Rolland, Soc. Myc. Fr. Bull. 15 : pl. 6. f. 3.

Type: location unknown to us.

Globose mass of several fructifications, pressed against each other like the carpels of an orange but easily separable, covered by a membranous peridium, floccose-silky, white, bluing rapidly to the touch. The peridium surrounds the outside of the fructification but not where the several fructifications come together. Gleba fleshy, flesh-colored, of round or oval cavities, no sterile portions; basidia 2-spored; spores brown, ellipsoidal, longitudinally striate,  $20 \times 12 \mu$ , guttulate. Floccose, radicating mycelium below, odorless. In cross-section the peridium shows distinctly, being blue where cut.

Among mosses clothing the base of an old tree (*Abies excelsa*), Bois du Bouchet near Chamonix, Sept. 15, 1898.

—Rolland.

This species seems to be a *Gautieria*, although we prefer not to make the transfer until we have seen the type. It seems quite possible that the columella is more strongly developed in this species, running all the way through the fructification and dividing the gleba into several distinct portions, as there is a tendency to do in *G. plumbea*. The spore color seems to relate it to the latter species if the colors of the illustration are to be trusted.

2. *Gautieria Otthii* Trog, Naturforsch. Ges. Bern Mitt. 1857 : 43. 1857 (in Nos. 388–390) [sometimes cited as Verzeichniss schweiz. Schwämme Nachtrag 3 : 43. 1857]; Saccardo & Sydow in Sacc. Syll. Fung. 14 : 268. 1899.

Fructification globose, 1–1¼ inch long, slightly narrower, with a “rootlet” at the base connected with a white columella. The long, somewhat winding cavities are numerous and small, visible with a weak lens, within larger but uniformly distributed, and as there is no peridium, the cavities are visible on the upper surface, of the same form as those within. They are wholly formed by the hymenium which bears striped, egg-shaped spores on short basidia. Spores brown and filled with granules. Odor weak, unpleasant.

Hardlisberg, Switzerland. *Otth.*

—Trog.

There seems to be nothing in the above description to differentiate *G. Otthii* from *G. graveolens* Vitt. As both common species of *Gautieria* have been reported from Switzerland and as Trog reports *G. morchelliformis* Vitt., it seems highly probable that this species should be reduced to synonymy, but it seems unwise to do so before studying type material or material from the type locality.

3. *Gautieria Drummondii* Cooke, Handbook of Australian Fungi, 247. 1892.

Illustration: Cooke, Handbook of Australian Fungi, pl. 15. f. 130.

“Subglobose, small; cells sinuous; spores ellipsoid, with large nucleus, 14–15×8  $\mu$ , hyaline.

“In the soil. W. Australia.”

—Cooke.

Cooke described this form from a specimen (No. 4446 in Berkeley's herbarium) in fragmentary condition. If Cooke's drawings are at all reliable, this plant is a *Rhizopogon* and would probably fall into synonymy in that genus. The spore measurements are rather larger than in many species of *Rhizopogon*, but much smaller than any in *Gautieria* except *G. monticola* and *G. plumbea*. Only a study of the type material can decide the position of this species. The description would fit either genus.

## EXPLANATION OF PLATE

## PLATE 9

Fig. 1. Spores of *Gautieria morchelliformis*;  $\times 1000$ .

Fig. 2. Spores of *G. graveolens*;  $\times 1000$ .

Fig. 3a. Showing the forms of hyphae in the evanescent peridium of *G. Trabuti*;  $\times 625$ .

Fig. 3b. The guttulate paraphyses of *G. Trabuti*;  $\times 1000$ .

Fig. 3c. A cystidium of *G. Trabuti*;  $\times 1000$ .

Fig. 3d. Showing basidia and spores of *G. Trabuti*, the ribs of the spores being usually warted;  $\times 1000$ .

Fig. 4a. A vertical median section of a fructification of *G. plumbea*, showing the stalk, branching columella and gleba; nat. size.

Fig. 4b. Section of the hymenium of *G. plumbea*, showing gelatinized tramal hyphae, angular cells of the subhymenium, paraphyses, cystidia, and basidia;  $\times 625$ .

Fig. 4c. Showing a cystidium with apiculate tip;  $\times 625$ .

Fig. 4d. Spores of *G. plumbea*;  $\times 1000$ .

Fig. 5. Spores of *G. monticola*;  $\times 1000$ .

